United States Department of Agriculture,

OFFICE OF EXPERIMENT STATIONS.

FOURTH REPORT OF COMMITTEE ON METHODS OF TEACHING AGRICULTURE.[1]

The committee on methods of teaching agriculture submits a fourth report of progress. Continuing the plan followed in its third report, the committee has made a special study of the subject of zootechny during the interval since the meeting of the Association in Washington in November, 1898, and presents herewith an outline of a course in zootechny framed with special reference to the requirements of the four-years college course in agriculture as set forth in previous reports.

Considering the conditions under which your committee is compelled to work, with its widely scattered membership and the consequent infrequent opportunities for conference, the reports submitted to the Association from time to time are necessarily imperfect in detail and as progress reports represent only the efforts of the committee to fulfill in some measure the purposes for which it was created and to furnish the Association with a basis for the systematic discussion of the just limits and proper arrangement of a college course in agriculture. For this reason the committee has not asked the Association to indorse its reports in any case, and would not deem it wise to have any definite action taken at this stage of progress in its work. Only after it has gone over all the main divisions of the general subject of agriculture will the material be at hand for a just estimate of the relations of the different parts of the syllabus presented in piecemeal in the different reports. Meanwhile explanation and discussion of its plan as far as revealed will be highly serviceable to the committee, and it congratulates itself on having so far attracted the attention of the Association as to have its reports made a special subject for consideration at this meeting. Preliminary to this discussion it may be well to state a few of the general considerations on which the work of the committee has been based.

(1) The arrangement of the topics to be taught under each head in a logical and pedagogical order has been deemed of fundamental importance. Unless the facts and principles taught under the general head of agriculture can be reduced to a pedagogical system and correlation, it will be difficult to maintain for agriculture that position in our educational scheme to which we believe it is fairly entitled. The syllabus of the committee should therefore be judged primarily with reference to its conformation to sound pedagogical principles. The danger is that too much stress will be laid on the present and, as we sincerely hope, temporary exigencies of particular colleges as affecting the scope and order of their course in agriculture. While the committee desires to have the outcome of its work practical as well as correctly theoretical, it believes that it is to consider first,

[1] Committee of the Association of American Agricultural Colleges and Experiment Stations, whose fourth report was presented to the convention of the Association held at San Francisco, Cal., July 5–7, 1899. For previous reports see U. S. Dept. Agr., Office of Experiment Stations Buls. 41, p. 57; 49, p. 29, and 65, p. 79, and Circs. 32, 37, and 39.

what is the most perfect arrangement of an agricultural course from a pedagogical standpoint, and afterward, how such a course may be wisely adapted to the prudential necessities of existing institutions.

Again, we ask that in the discussion of this subject the order and method of treatment followed in certain widely used text-books and manuals may not be deemed so firmly established as correct as to preclude further inquiry in this direction. It is natural and right that we should have reverence for the standard authorities of our school days and college lecture rooms, but it is an easy step from this to confound creed with revelation. And at this stage in the progress of agricultural education we believe that a most necessary thing is to submit existing manuals to rigid examination with reference to their pedagogical merits. It may be a difficult thing for some of us to appreciate the superiority of any revised version of agricultural scriptures, but unless we bring to this discussion an open mind and willingness to examine the subject from different points of view, it will be of little use to enter upon it.

(2) The committee has deemed it wisest to plan the course in different branches of agriculture without special reference to the titles of the teachers who might be called upon to teach the different topics included therein. In our view it makes little difference whether some unfortunate "professor of agriculture" is compelled to bear the heavy burden of guiding the student through the entire course, or whether numerous specialists give their combined energies to the task. Thus different parts of agronomy might be taught by the chemist, physicist, fertilizer expert, botanist, agrostologist, plant culturist, etc.; or zootechny by the physiologist, veterinarian, expert breeder, dairy farmer, sheep husbandman, etc.

Again, the amount of detail to be taught under different topics will naturally vary with the previous training of the pupil in scientific subjects, and with the provision made in other courses for instruction in subjects related to agriculture. Thus, if the student has had or is to have a thorough course in geology, he will not need to pay much attention to the topics included under "origin of soils" in the course in agronomy; or if soil physics is a separate department of instruction, matters relating to the properties, moisture, etc., of soils need not be much dwelt upon in the course in agronomy; or the discussion of fertilizers may be largely turned over to the course in agricultural chemistry.

But on the other hand, we are inclined strongly to contend that in the courses in agriculture a comprehensive scheme of instruction should be adopted, and that all the topics should be included which are necessary to a clear understanding of the proper relations of the different parts of the subject. We hold that there is such a thing as a science of agriculture, secondary and complex in its nature, and deriving its facts and principles very largely, if not wholly, from other more primary sciences, but after all to be differentiated as a distinct entity from the other sciences, however dependent it may be on them for its materials. And we urge that one radical defect of agricultural instruction thus far has been that so much of the teaching of agricultural subjects has been done in a disjointed way by experts in different branches of science. The student has therefore often not had the subject of agriculture presented to him as a connected whole with related parts, and has for this reason failed to

appreciate that there was any such thing as a science of agriculture, or has not learned to make any useful application of what he has learned in various sciences to either the theory or the practice of agriculture. Thus, we believe, for example, that however much the student may have learned or will learn about the physiology of plants, or the physics of soils, or the chemistry of fertilizers, at some period in his agricultural course he should have all these subjects grouped together in a course in agronomy and there learn their relation to each other and to the methods employed in the production of crops in actual agricultural practice. If the student has had considerable previous training in vegetable physiology, soil physics, and agricultural chemistry, the wise teacher will take advantage of this by quizzes or a system of references, and rejoice in the opportunity this gives him to enter more deeply into complex topics of agricultural science and practice involving a combination of the preliminary sciences; or if a more complete course in these other sciences awaits the student, the teacher of any branch of agriculture should confine himself to such an outline as will show the necessary relation of these sciences to the science and practice of agriculture, and deeply impress upon the student the great desirability of his improving every opportunity for wider scientific training if he would most thoroughly comprehend the intricacies and subtleties of the science of agriculture. In our view, the teaching of any secondary science such as meteorology, geography, medicine, or agriculture, involves a pedagogical scheme which brings together into a consistent whole whatever more or less disconnected facts and principles of other sciences related to the composite science have already been learned by the student, and which at the same time leads the student to desire to broaden and deepen his acquaintance with the basal sciences, however long he may study the composite one. One of the great pedagogical advantages, as it seems to us, which such a science as that of agriculture enjoys is that it necessitates a broadly related knowledge of a number of basal sciences. If generally and efficiently taught in our colleges it will do much to counteract the pernicious influences of a narrow specialism which has in recent years been fostered by a false eclecticism. This requires, however, that agriculture in its scientific and practical aspects shall be treated as a distinct entity and not be hopelessly dismembered in the scheme of college instruction.

(3) While we have held somewhat rigidly to the foregoing pedagogical considerations, we have, nevertheless, attempted to make a scheme sufficiently elastic to readily adapt itself to the requirements of institutions having considerable variations in the grade of agricultural instruction, and differing widely in the number of teachers and of courses in scientific and other subjects. For this reason we have refrained from making definite suggestions regarding the amount of time to be given to different topics, and have called attention to the fact that the number of different kinds of plants and animals which it will be well to consider in detail will properly vary with circumstances. The kind of agriculture in the environment of any institution will naturally suggest the various limitations of this branch of the agricultural course, but aside from this such conditions as lack of teachers or equipment will largely determine the extension or restriction of these topics.

SYLLABUS OF COURSE IN ZOOTECHNY.

ZOOTECHNY.—Theory and practice of the production of animals useful to man. Broadly speaking, zootechny would also include the diseases of such animals, but as this is a large subject in itself and would most naturally be taught in a separate department under the head of veterinary science (as is proposed in the course in agriculture outlined by this committee, second report, page 2), it seems best to confine zootechny as a division of technical agriculture to that which relates to the production of the normal useful animal.

- **The Animal**
  - Anatomy (details to be taught under veterinary science).
  - Physiology (details to be taught under general physiology).
  - Management[1]
    - Animal types.
    - Breeding.
    - Feeding.
    - Hygiene.
    - Systems of management.
- **Animal production**
  - In agriculture has for its object the securing and growing of animals which in themselves or in their products are best suited to the uses of man.
- **Classification of useful animals.** (This is only a partial classification and the animals named under each class will vary according to circumstances.)
  - Mammals
    - Herbivora
      - Cattle.
      - Sheep.
      - Goats.
      - Swine.
      - Camels.
      - Horses.
      - Asses.
      - Mules.
      - Rabbits.
      - Hares.
    - Carnivora
      - Dog.
      - Cat.
  - Birds
    - Fowls.
    - Ducks.
    - Geese.
    - Pigeons.
    - Turkeys.
    - Pheasants.
    - Ostriches.
  - Fishes
    - Salmon.
    - Trout.
    - Carp.
  - Insects
    - Bees.
    - Silkworms.
  - Miscellaneous
    - Frogs.
    - Oysters.
    - Snails.

[1] Under the head of animal production we need most largely to consider those topics which relate to man's agency in obtaining the results with animals desired in practical agriculture, and which are conveniently grouped under the general topic—management.

- **1. Principles governing the choice and breeding of animals.**
  - Animal types
    - Conformation.
    - Animal mechanism.
    - Methods of scoring.
  - Breeding
    - Heredity
      - Normal characters.
      - Abnormal characters.
      - Atavism.
    - Variation
      - Causes.
      - Laws.
    - Selection
      - According to merit.
      - According to relationship (pedigrees)
        - In breeding.
        - Cross breeding.
    - Prenatal influence
      - Sire and dam.
      - Maternal impression.
      - Previous impregnation.
    - Fecundity.
    - Sex.
- **2. Types and breeds of different kinds of animals.**
  - Class
    - Place of classification.
    - Anatomy.
    - Physiology.
    - Zoological relation.
    - Domestication.
    - Varieties or breeds
      - Classification.
      - Characters.
      - Development.
      - Distribution.
      - Breeders' organizations.
    - Stock judging (practice in scoring).
    - Breeding (relation of principles to practice).
- **3. Principles of feeding.**
  - Foods
    - Nature (as related to the animal organism).
    - Constituents
      - Refuse.
      - Edible portion.
        - Water.
        - Nutrients.
          - Protein.
          - Fats.
          - Carbohydrates.
          - Mineral matters (ash).
    - Functions.
    - Classes
      - Coarse fodders.
      - Concentrated feeding stuffs.
    - Composition.
    - Digestibility.
    - Effects
      - On condition of animal.
      - On product.
    - Manurial value.
  - Food requirements (of different animals for different purposes).
  - Feeding standards.
  - Rations
    - Compounding.
    - Methods of use.

- **4. Practice in feeding different kinds of animals.**
  - Food requirements (feeding standards)
    - For maintenance.
    - For growth.
    - For meat, fattening.
    - For wool and hair.
    - For milk.
    - For work.
  - Rations
    - Compounding.
    - Methods of use.
    - Economy.
  - Systems of feeding.
  - Effect of food
    - On condition of animal.
    - On product.
- **5. Principles of hygiene and management.**
  - Hygiene
    - Air supply.
    - Water supply.
    - Exercise.
    - Cleanliness.
    - Comfort.
    - Protection; e. g., against heat, cold, accident, escape.
    - Modification of body
      - Dehorning.
      - Docking.
      - Shearing.
      - Castration.
      - Spaying.
  - Systems of management
    - For single animals.
    - For groups of animals (herds, flocks, etc.).
      - Under different conditions; e. g., in freedom, in inclosures, or in buildings.
- **6. Practice in the management of different kinds of animals.**
  - Hygiene
    - Air supply.
    - Water supply.
    - Exercise.
    - Cleanliness.
    - Protection.
    - Modification of body.
  - Systems of management
    - For single animals.
    - For groups of animals.
  - Care of product.
  - Extent of production.
  - Marketing.

After considerable discussion, the committee decided upon the above order of topics as being probably the one most practical for adoption in American agricultural colleges. There are, however, some important considerations which may be urged in favor of teaching the principles of the different branches of zootechny together before taking up the application of any of them to different kinds of animals. In case that seemed best, the general topics in this syllabus might be re-arranged in the following order: 1, 3, 5, 2, 4, 6. The fundamental difference between the two schedules is indicated in the following summary:

SYLLABUS 1.

1. Principles governing the choice and breeding of animals.
2. Types and breeds of different kinds of animals.
3. Principles of feeding.
4. Practice of feeding different kinds of animals.
5. Principles of hygiene and management.
6. Practice in the management of different kinds of animals.

SYLLABUS 2.

Principles
- Animal types.
- Breeding.
- Feeding.
- Hygiene.
- Systems of management.

Application of principles to different kinds of animals; e. g.:

Horses
- Stock judging.
- Breeding.
- Feeding.
- Hygiene.
- Systems of management.

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Recommended for publication.

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